WHAT IS CLAIMED IS:

1. A method of attaching a nanostructure-containing material onto a sharp tip of an object, the method comprising:

(i) forming a suspension of nanostructure-containing material in a liquid medium;

(ii) immersing at least one electrode in the suspension;

(iii) placing the sharp tip into the suspension; and

(iv) applying a direct or alternating current to the immersed electrode and the sharp tip and causing at least a portion of the nanostructure-containing material in the suspension to become attached to the object proximate an apex of the sharp tip.

2. The method of claim 1, wherein the object comprises a point electron field emission source, a probe of an atomic force microscope, a probe of a scanning tunneling microscope, an electron source of a transmission electron microscope, an electron source of a scanning electron microscope, a probe of a magnetic force microscope, or a profilometer.

3. The method of claim 1, further comprising the step of functionalizing the nanostrucutre-containing material prior to step (i).

4. The method of claim 1, wherein steps (iii) and (iv) further comprise moving the tip toward the surface of the suspension until electrical contact is established with the suspension, maintaining the electrical contact for a predetermined period of time, and withdrawing the tip from the suspension.

5. The method of claim 4, wherein the nanostructure-containing material comprises carbon nanotubes, and wherein step (iv) further comprises

attaching an individual carbon nanotube, a nanotube bundle, or a nanowire to the sharp tip or attaching a fibril comprising a plurality of carbon nanotubes, nanotube bundles, or nanowires.

6. The method of claim 5, wherein the longitudinal axis of the individual carbon nanotube, nanotube bundle, or nanowire is aligned along a cone axis of the sharp tip.

7. The method of claim 5, wherein the longitudinal axis of the fibril comprising nanotube, nanotube bundle or nanowire is aligned along a cone axis of the sharp tip.

8. The method of claim 5, wherein the longitudinal axis of the nanotube, nanotube bundle or nanowire within the fibril is aligned along the longitudinal axis of the fibril.

9. The method of claim 5, wherein the fibril has a cylindrical-shaped body and two ends, wherein a first end of the fibril is attached to the apex of the sharp tip and a second end of the fibril has a tapered geometry and wherein the tip diameter of the tapered end is 0.5 nm to 100 nm.

10. The method of claim 5, further comprising annealing the tip after the nanotube, nanotube bundle, or nanowire is attached.

11. The method of claim 1, wherein step (iii) comprises placing a plurality of sharp tips into the suspension.

12. The method of claim 1, wherein step (iv) comprises applying an alternating current with a frequency of 10Hz to 10GHz.

13. The method of claim 1, wherein step (iv) comprises applying a direct current.

14. The method of claim 13, wherein step (i) further comprises adding at least one compound to the suspension in order to impart a charge characteristic to the nanostructure-containing material.

15. The method of claim 14, wherein the at least one compound comprises one or more of: $MgCl_2$, NaOH, $Mg(NO_3)_2$, $La(NO_3)_3$, $AlCl_3$.

16. The method of claim 5, wherein the nanostructure-containing material comprises at least one of:

a single-walled carbon nanotube; a multi-walled carbon nanotube; silicon; silicon oxide; germanium; germanium oxide; carbon nitride; boron; boron nitride, dichalcogenide; silver; gold; iron; titanium oxide; gallium oxide; indium phosphide; magnetic particles enclosed within a nanotube; a nanotube with a composition $B_xC_yN_z$; and a nanotube or concentric fullerene with a composition of MS_2 (M = tungsten, molybdenum, or vanadium oxide).

17. The method of claim 4, wherein the tip is gradually withdrawn from the surface of the suspension while under the applied current such that nanostructure-containing material is first assembled proximate an apex of the tip and then assembled onto previously attached nanostructure-containing material thereby forming a wire of nanostructure-containing material.

18. The method of claim 17, wherein the wire is formed with a diameter of .5 nm to100 μm.

19. The method of claim 1, further comprising annealing the sharp tip and nanostrucutre-containing material after step (iv).

20. A wire having a diameter of 0.5 nm to 100 μm comprising nanostructure-containing material.

21. The wire of claim 20, having a diameter of 0.5nm to 1μm.

22. The wire of claim 21, having a length of 50nm to 50μm.

23. The wire of claim 20, wherein the nanostructure-containing material comprises carbon nanotubes.

24. The wire of claim 23, wherein the carbon nanotubes comprise single-walled carbon nanotubes.

25. The wire of claim 20, formed by the method of claim 17.

26. The method of claim 1, wherein step (iv) comprises attaching one carbon nanotube on the apex of a sharp tip, wherein a longitudinal axis of the carbon nanotube is aligned along a cone axis of the sharp tip, and wherein an end of the carbon nanotube pointing away from the apex of the sharp tip contains a magnetic particle.

27. The method of claim 26, wherein the sharp tip is a probe of an atomic force microscope.

28. The method of claim 26, wherein the magnetic particle is encapsulated by the carbon nanotube.

29. A device comprising:

a generally conical sharp tip having a cone axis; and

a fibril comprising nanostructure-containing material attached to the sharp tip and generally aligned along the cone axis of the sharp tip, the fibril having a diameter of 0.5nm to 1.0μm.

30. The device of claim 29, wherein the device comprises a point electron field emission source.

31. The device of claim 29, wherein the device comprises a probe of an atomic force microscope, a scanning probe microscope, a transmission electron microscope, a scanning electron microscope, a magnetic force microscope, or a profilometer.

32. The device of claim 29, wherein the sharp tip is formed of tungsten.

33. The device of claim 29, wherein the nanostrucutre-containing material comprises at least one of:

a single-walled carbon nanotube; a multi-walled carbon nanotube; silicon; silicon oxide; germanium; germanium oxide; carbon nitride; boron; boron nitride, dichalcogenide; silver; gold; iron; titanium oxide; gallium oxide; indium phosphide; magnetic particles enclosed within a nanotube; a nanotube with a composition $B_xC_yN_z$; and a nanotube or concentric fullerene with a composition of MS_2 (M = tungsten, molybdenum, or vanadium oxide).

34. The device of claim 29, wherein the fibril comprises: a single carbon nanotube, a plurality of carbon nanotubes, a single carbon nanotube bundle, or a plurality of carbon nanotube bundles.

35. The device of claim 34, wherein the carbon nanotube or carbon nanotubes comprise single-walled carbon nanotubes.

36. The device of claim 29, wherein the fibril has a length of 50nm to 50μm.

37. The device of claim 29, wherein the devices exhibits an emitted electron current of greater than 0.5 microamperes, and a current decay after 10 hours of continuous operation of less than 15%.

38. The device of claim 29, wherein the devices exhibits an emitted electron current of greater than 1.0 microamperes, and a current decay after 10 hours of continuous operation of less than 15%.

39. The device of claim 29, wherein the devices exhibits an emitted electron current of greater than 3.0 microamperes, and a current decay after 10 hours of continuous operation of less than 15%.

40. The device of claim 29, wherein the devices exhibits an emitted electron current of greater than 5.0 microamperes, and a current decay after 10 hours of continuous operation of less than 15%.

41. The device of claim 29, wherein the attached fibril has a substantially longitudinal axis which defines an angle with the cone axis of the sharp tip, the angle being less than 15 degrees.

42. The device of claim 29, wherein the attached fibril has a substantially longitudinal axis which defines an angle with the cone axis of the sharp tip, the angle being less than 10 degrees.

43. A method of making an electrical connection between a plurality of components, the method comprising:

(i) forming a suspension of nanostructure-containing material in a liquid medium;

(ii) bringing the suspension into contact with the components; and

(iii) applying a direct or alternating current to the components thereby establishing an electrical field therebetween causing a wire to be formed from the nanostructure-containing material connecting the components.

44. The method of claim 43, wherein the plurality of components comprises two components.

45. The method of claim 43, wherein the plurality of components comprise four components, step (ii) comprises brining the suspension into contact with all four components, and step (iii) comprises applying direct or alternating current to a first pair of components to form a first connection therebetween, and then applying direct or alternating current to a second pair of the components to form a second connection therebetween.

46. The method of claim 43, wherein the components comprise components disposed on a circuit board.

47. The method of claim 43, further comprising annealing the tip after the nanotube, nanotube bundle, or nanowire is attached.

48. The method of claim 43, wherein step (iii) comprises applying an alternating current with a frequency of 10Hz to 10GHz.

49. The method of claim 43, wherein step (iii) comprises applying a direct current.

50. The method of claim 49, wherein step (i) further comprises adding at least one compound to the suspension in order to impart a charge characteristic to the nanostructure-containing material.

51. The method of claim 50, wherein the at least one compound comprises one or more of: $MgCl_2$, NaOH, $Mg(NO_3)_2$, $La(NO_3)_e$, $AlCl_3$.

52. The method of claim 43, wherein the nanostructure-containing material comprises at least one of:

a single-walled carbon nanotube; a multi-walled carbon nanotube; silicon; silicon oxide; germanium; germanium oxide; carbon nitride; boron; boron nitride, dichalcogenide; silver; gold; iron; titanium oxide; gallium oxide; indium phosphide; magnetic particles of Fe, Co or Ni enclosed within a nanotube; a nanotube with a composition BxCyNz; and a nanotube or concentric fullerene with a composition of MS_2 (M = tungsten, molybdenum, or vanadium oxide).

53. An arrangement comprising:

a first component;

a second component; and

a first wire comprising nanostructure-containing material, the wire attached to both the first and second components and providing an electrical connection therebetween.

54. The arrangement of claim 53, wherein the wire is formed by the method of claim 43.

55. The arrangement of claim 53, further comprising:

a third component;

a fourth component; and

a second wire comprising nanostructure-containing material, the wire attached to both the first and second components and providing an electrical connection therebetween.

56. The method of claim 55, wherein the second wire is formed by the method of claim 43.

57. The arrangement of claim 53, wherein the components are disposed on a circuit board.

58. A method of separating groups of nanostructure-containing materials, the method comprising:

(i) forming a mixture comprising the groups of nanostructure-containing materials to be separated and a liquid medium;

(ii) introducing a plurality of electrodes into the mixture;

(iii) establishing an asymmetrical electrical field within the mixture;

(iv) polarizing the groups of nanostructure-containing materials in the mixture, thereby causing at least a first group to migrate to a first electrode and causing a second group to migrate to a second electrode; and

(v) recovering at least the first group from the liquid medium at the first electrode.

59. The method of claim 58, wherein step (v) further comprises recovering the second group from the liquid medium at the second electrode.

60. The method of claim 58, wherein the first group comprises conductors and the second group comprises semiconductors.

61. The method of claim 60, wherein the conductors comprise metallic or conductive carbon nanotubes and the semiconductors comprise semiconducting carbon nanotubes.

62. The method of claim 58, wherein the liquid medium comprises water.

63. The method of claim 58, wherein step (iii) further comprises applying an alternating current.

64. The method of claim 63, wherein step (iv) comprises adjusting the frequency of the applied alternating current.

65. A method of separating a first group of particles from a second group of particles contained in a mixture, at least one of the first and second groups of particles comprising a nanostructure-containing material, the method comprising:

(i) forming an arrangement of electrodes;

(ii) applying an alternating current power source to the arrangement;

(iii) bringing the mixture into proximity with the arrangement;

(iv) polarizing the first group of particles differently than the second group of particles;

(v) separating the first group of particles from the second group of particles based on differences in polarity; and

(vi) recovering at least one of the first or second group of particles.

66. The method of claim 65, wherein the nanostructure containing material comprises carbon nanotubes.

67. The method of claim 65, wherein the mixture comprises a liquid medium.

68. The method of claim 65, wherein step (i) comprises forming a plurality of electrodes intersecting at 90° relative to one another.

69. The method of claim 65, wherein step (i) comprises forming a plurality of concentric electrodes.

70. The method of claim 69, wherein step (ii) comprises applying an alternating current to each of the concentric electrodes that is at least 90° out of phase with the other concentric electrodes.

71. The method of claim 65, wherein step (v) comprises adhering at least one group of particles to the electrodes.